Operational Art and the Wargame: Play Now or Pay Later

A Monograph
by

Major Robert A. Rosenwald
Air Defense Artillery

School of Advanced Military Studies
United States Army Command and General Staff College
Fort Leavenworth, Kansas

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ABSTRACT

Wargames have long been used to educate soldiers in the art of war. Today, diminishing resources and expanding technologies have made the games an indispensable feature of the US Army's formal training and education system. Much has been written about wargames designed to train commanders and staffs at the tactical level of war. Much less, however, has been written on the use of the wargame to educate soldiers in the practice of operational art. This monograph is the author's attempt to fill this void, and in so doing, introduce a set of criteria which can be used as a guide in further studies of the subject.

Theory serves as the foundation for these criteria, and the analysis begins with a review of the theoretical underpinnings of wargames, education, and operational art. These criteria are further developed through historical analysis. The criteria are then applied to the current wargaming efforts of the US Army. The analysis concludes with the implications of the study, and a proposed model of how wargames should be conceptualized.

The author concludes that wargames used to educate soldiers in operational art must be Realistic, Flexible, Efficient, and Educationally Sound. He also concludes that a tension exists between these criteria. Currently, our efforts to make wargames Realistic have had many negative impacts on the other three criteria. Wargames have much more to offer should more attention be paid to the ways to make them Educationally Sound. What is needed, then, is a balanced emphasis on the criteria. The author's model is an attempt to show how operational level wargames used for educational purposes should fit into an overall educational framework.

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Major Robert A. Rosenwald

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Approved by:

Harold R. Winton, Ph.D. — Monograph Director

Colonel William H. Janes, MA, MMAS — Director, School of Advanced Military Studies

Philip J. Brookes, Ph.D. — Director, Graduate Degree Program

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"It is a common observation, and a true one, that practical qualities in a soldier are more important than a knowledge of theory. But this truth has often been made the excuse for indolence and indifference, which except in rare and gifted individuals, destroys practical efficiency. It is also true that, other things being equal, the officer who keeps his mind alert by intelligent exercise, and who systematically studies the reasons of actions and the materials and conditions and difficulties with which he may have to deal, will be the stronger practical man and the better soldier."

- Elihu Root, 1903

I. INTRODUCTION

Since the times of Sun Tzu, wargames have been used to educate soldiers in the art of war. Throughout this period, the games have paralleled the art, as well as the society from which they have arisen. Although the earliest games were designed as much for entertainment as education, the seriousness and complexity of warfare was soon to be reflected in the styles of the wargames. By the late 1800's wargames had developed into important educational tools. Foremost in the use of these was the German Army.

The German Army's greatest achievements in wargaming were to take place during the interwar years of the 1920's and 1930's, a time when the Army depended on the wargame to take the place of field maneuvers denied them by the Versailles Treaty.[1] Not only did the games provide a viable synthetic experience, but they also proved to be an excellent way of advancing the theoretical understandings of the officer corps.

Our Army now faces many of the same challenges. Though we have emerged victorious from the Cold War, numerous political and budgetary factors assure an environment nearly as restrictive as that faced by the post World War I German Army. We face another challenge, though, that was spared the Germans. For us, the current emphasis on operational art itself may be questioned, as perceived threats diminish, and restrictions impose high costs on the practice of the art.

Wargames promise to be a part of the answer to these challenges. Indeed, the U.S. Army has already relied on analytical and training wargames for some time now. However, we appear to be much less proficient in using wargames to educate, especially at the operational level. With the importance likely to be placed on wargaming in the future, it is imperative that we understand what the wargame is and how it can be used at the operational level. Otherwise, we may just be playing games.

Thus, the central questions of this paper are, 'What are the essential criteria of wargames used in the education of operational artists?' and when these are compared to current Army efforts, 'How are we doing?' Critical to both questions are the definitions of operational art, education, and wargames.

Operational art is defined in FM 100-5, Operations, as 'the employment of military forces to attain goals in a theater of war or theater of operations through the design, organization, and conduct of campaigns and major operations.'[2] Operational art is most often practiced by theater commanders and their major subordinate commanders, and inherently includes joint and combined operations on the land and sea, and in the air.

Education is instruction or individual study for the purpose of intellectual development and the cultivation of wisdom and judgement.[3] Education can be distinguished from training, which is oriented more on a particular skill or technical proficiency.[4]

Wargames are defined by the Department of Defense as a simulated military operation involving two or more opposing forces, using rules, data, and procedures to depict an actual or assumed real life situation.[5] Obviously, a great range of activities can be included, ranging from actual field maneuvers to closed computer simulations. The intent of this paper is to discuss only those wargames used in an indoor educational setting. Therefore, for purposes of this study, a wargame can be defined as an imaginary military operation involving two or more human players, conducted upon a map, board, or computer in which devices or symbols are moved about according to rules representing the conditions of actual combat.[6]

There exists among these three terms a simple relationship. Education is a way to develop understandings of operational art, and wargames are a means to that end.

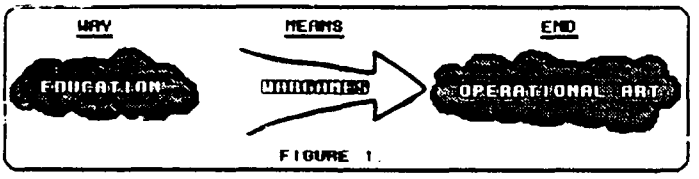


FIGURE 1.

The answer to the research question, then, is to be found within the arrow above. Section II, Theoretical Foundations, will begin sketching the outline of the arrow. Here, the theory of operational art, education, and wargames will be briefly discussed, and the criteria for evaluating operational level wargames will be introduced. These criteria will be further developed in Section III,

Historical Analysis. Then, in Section IV, Contemporary Analysis, the criteria will be applied to the current wargaming efforts of the U.S. Army. This should make clear the dimensions of the arrow as we have currently drawn it. A summary of the paper will follow in Section V, Conclusions. Finally, in Section VI, Implications, some alternatives will be offerred, should we decide to redraw the arrow completely.

II. THEORETICAL FOUNDATIONS

Wargames

Of operational art, education, and wargames, the "theory" of wargames is, without a doubt, the least well defined.[7] One simply cannot go to the bookshelf and pull out a book on the theory of wargames.

Two solid steps have been taken, however, towards the formulation of such a theory. First, is the general consensus on the value of the wargame. Regardless of source, wargames are valued for their ability to provide artificial experience when actual experience would be too costly, risky, controversial, or simply unavailable.[8,9]

Second, the theory is also well categorized. Various taxonomies have been used to divide and subdivide the categories of the games through the years, the most important of which have been summarized in Appendix 1.

Common to all of these taxonomies are a certain number of elements which all wargames possess. Objectives are

central to all else, defining the purpose of the wargame itself. The scenario sets the stage for the game. It can have significant, if not overwhelming, effect on the game. The data base contains all of the information players need to make decisions. Models, usually in the form of mathematical expressions, translate the data into events. The game must also have rules and procedures, which sequence the game and allow for chains of cause and effect. Finally, the game must have human players 'in the loop' of the decisions.[10]

How these elements are formulated and blended together comprise the design of the wargame. Ultimately, the success of the design will be measured in terms of enhanced performance in time of war. Short of this test, other criteria must be specified.

To date, a substantial amount has been written about the criteria for evaluating tactical level wargames. Much less, however, has been written about the criteria useful for operational level wargames. In fact, the best source found in this matter was in a product pamphlet of a major defense consulting firm.

According to these wargame designers, three criteria stand out as important. First, the game must be of proper scope. This means that appropriate units, systems, and functions must be replicated in the game. This is not to say, however, that scope is the equivalent of detail. Rather, it is a question of comprehensiveness relative to the level of war being gamed. Second, is the criterion of

flexibility. This means that the game must be able to be used in a number of different situations and with a number of different scenarios. The game must also accommodate a variety of audiences. Third, the game must be efficient. Time of the players is valuable, and must not be squandered with laborious gaming methods.[11]

These criteria will be useful to us in defining the limits of the arrow in Figure 1. Since our target is operational art, however, let us now review what the theory of operational art has to offer, and how it might suggest some additional criteria.

Operational art

Although our doctrine has included the concept of operational art for only a relatively short period of time, the theory behind the doctrine has existed for well over a hundred years. Much of this theory, of course, belongs to Carl von Clausewitz, who wrote his seminal On War in the early years of the nineteenth century.

A central concern of Clausewitz was the distinction between tactics and strategy (most of what he discussed in terms of strategy is now referred to as operational art). Tactics, he said, was concerned with the engagement; strategy, with the use of the engagement for the objects of war.[12] In part, this distinction was one simply of dimension. Engagements, after all, were smaller than campaigns, and divisions much less expansive than armies.

In larger part, however, Clausewitz saw the distinction

as one more of quality than of quantity. He saw the difference between the levels of war not so much in the multiplication of assets and areas of responsibility, but in the magnification of danger, exertion, uncertainty, and chance. For Clausewitz, doubt caveats every decision at the higher levels of command and changes the very essence of leadership. He writes,

> In a tactical situation one is able to see at least half the problem with the naked eye, whereas in strategy everything has to be guessed at and presumed. Conviction is therefore weaker. Consequently most generals, when they ought to act, are paralyzed by unnecessary doubts.[13]

To the problems of doubt and uncertainty is added the issue of perspective, especially since theory now calls on operational art to link together the two very disparate domains of tactics and strategy.[14] In effect, this requires of the practitioner of operational art the ability to reside in two worlds. On the one hand, he must deal with the intangible at the strategic level, and on the other, with the tangible at the tactical.

Thus, there are a number of qualities demanded of all operational leaders and planners. For Clausewitz, the most important of these were judgment, courage, determination, and intelligence. Together these create genius, which he defined as 'a very highly developed mental aptitude for a particular occupation.'[15] Complementing genius was his notion of coup d'oeil, which he defines as the ability of a commander to 'see things simply, to identify the whole

business of war completely within himself.'[16]

The challenge to the wargame, then, is not only to represent the nature of the operational level, but also to provide the experience which might develop the qualities inherent to the practice of the art. Quantity alone does not define the operational arena, and operational wargames must not just be tactical games writ large. Rather, they must thoroughly embrace the nature of operational art. This suggests that operational wargames be judged not only on the criteria of scope, flexibility, and efficiency, but also on how well they replicate the moral and intellectual aspects of the art as well.

But now one must ask, 'How does an officer become educated in the art?' Any answer must be firmly founded on the theories of learning and education.

Learning and Education

As one might expect, genius and coup d'oeil are not in the lexicon of the theories of learning or education, nor are there any discussions about the cultivation of practitioners of operational art. Much work has been done, however, in attempting to answer questions about 'higher order skills' very similar to those posed above.[17] We would be well advised to look at these efforts, and apply what is appropriate to our study of wargames.

In recent years much of this work has been done within the discipline of cognitive science. Cognitive science is concerned with the study of the expert, and with expert

problem solving techniques in professional-level tasks. Researchers in the field attempt to gain an understanding of the differences between novices and experts, and search for ways how novices might learn to become experts.[18]

A central characteristic of the expert, it has been found, is the ability to make nonrational, as well as rational decisions.[19] Nonrational decisions are those that are made on the basis of intuition or judgment. Judgmental decisions differ from rational ones in that the orderly analysis of the situation is missing, with the expert relying on 'gut feel'. Having made these types of decisions, the expert is often at a loss to explain the process by which the decision was made.

Theorists have been divided on how this intuitive ability is developed. One school of thought has stressed the importance of heuristics and general self-monitoring strategies. In today's parlance, these are known as metacognitive skills.[20] According to this view, the difference between the expert and the novice is simply that the expert has better developed these skills.[21]

The second school of thought sees the intuitive expert not so much as a master of heuristics, but rather as one who can reason forward from what is already known.[22] Here, the knowledge base is critical: Intuition and judgement are simply 'analyses frozen into habit and into the capacity for rapid response through recognition.'[23]

Many now see the importance of both, and theorize that reality lies somewhere between the extremes of the two

schools of thought. In this synthesis, general cognitive skills are seen as important, but only in the context of a specific domain of knowledge. The skills are not seen as taking the place of specific knowledge, but rather as a tool to be used when the expert faces an atypical situation for which little information exists.[24]

Education theory echoes this call for synthesis. It, too, has long been divided over the issue of whether or not detailed knowledge is more important than a general problem solving abilities.[25] Combining the two into one process is important to educators for several reasons. First, it represents an effective use of time. Since general knowledge strategies develop only over a long period of time, promotion of them should begin early, in the course of acquiring factual information. Second, and perhaps more importantly, such a tactic prevents general knowledge from becoming abstracted from the specific.[26]

For the educator, then, 'basic' and 'higher order' skills cannot be separated. This, in turn, has had a great impact on instructional design (which is concerned with the social settings needed for learning to take place).

Paramount is the concept of the small group. The small group is important because it provides for the general conditions conducive for cognitive development. These conditions include the freedom to explore new ideas and take chances, an understanding that success is not of overriding significance, an acceptance of failure, a high level of trust, and an overall low threshold of

bureaucratic obstacles.[27] Even more importantly, small groups allow members to see problems as a whole, rather than as small bits in isolation from one another.[28]

Another reason why the small group is important is because it makes possible a number of instructional techniques generally agreed to be helpful in the development of higher cognitive skills. Some of the specific techniques include modeling, 'cooperative learning,' and 'reciprocal teaching.'[29]

In all, learning and education theory provide several insights for our study. Clausewitz's genius of yesterday, for one, sounds much like the cognitive scientist's expert of today. In addition, we also have reason to believe that the expert's judgment and intuition (coup d'oeil?) can be learned, or at least developed. If wargames are to educate officers in the operational art, the games must certainly be designed with the factors mentioned above in mind. This suggests another criterion for our study, one which I will call 'Educationally Sound.'

Tentative Criteria

Taken together, the theories of wargames, operational art, and wargames suggest several criteria. These are illustrated on the next page, in Figure 2.

As can be seen, this illustration is simply an adaptation of the criteria previously described in the section on wargame theory. The criteria of Flexible and Efficient are listed as discussed. The criterion of Scope,

however, has been renamed Replicates the Operational Level, and to it has been added Replicates the Operational Art. Together, the two of these determine how 'Realistic' the wargame is. Finally, the criterion of Educationally Sound has been added, in recognition that judgment and intuition can be taught, given certain educational practices.

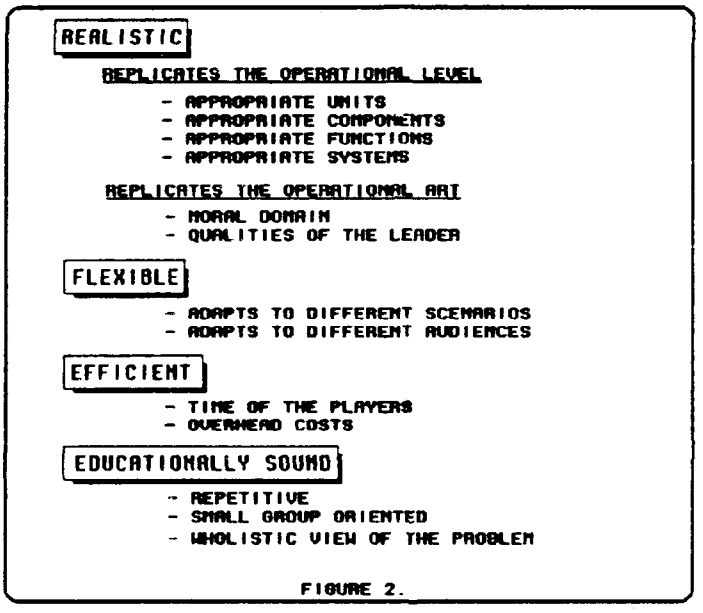


FIGURE 2.

III. HISTORICAL ANALYSIS

Although the exact origin of the wargame is unknown, it is usually ascribed to either the Japanese game of Go, the Chinese game of Wei-Hai, or the Hindu game of Chaturanga, all of which flourished 3,000 to 4,000 years ago.[30,31] Eventually, Chaturanga was imported by the Europeans, who simplified it into the current game of chess.[32]

Appropriately, chess became the basis for the earliest of the war games. Called 'war chess', these games used pieces more easily identifiable with the military than did

ordinary chess.[33] One of the first of these games, and perhaps the best known, was a game called Koinigspiele or 'King's Game,' which was developed by the Prussian Christopher Weikhmann in 1644. It was used exclusively in the education of royalty in the art of war.[34]

War chess continued to develop throughout the eighteenth century, increasingly taking on added complexity as the 'vogue of military mathematics', and science, impacted on war. Most prominent of these mature war chess games were Helwig's 'War Chess' and Georg Vinturinius' New Kriegsspiel developed in 1780 and 1798 respectively.[35] Originally designed for pastime pleasure, these games eventually became extremely cumbersome and tedious to play. By the turn of the century the revolution of Napoleonic warfare rendered the games obsolete.[36,37,38] Soon war chess was supplanted with more realistic representations of war.

The first game to break away from the use of a chessboard was invented by Baron von Reisswitz in 1811. Later his concepts were adapted by his son, and in 1824 von Reisswitz the Junior developed what is now recognized as the first 'modern' wargame.[39] The game, which came to be known as Kriegsspiel, was played on actual maps, though movement and combat continued to be resolved by rules. As with war chess, these rules tended to become complex with the passage of time.[40]

The quick victories by Prussia in 1866 and 1870-71 caused emphasis to shift away from complex rules. The

experience of actual combat, it was felt, could replace the cumbersome and unpopular rules. By 1876, the eminent instructor Colonel (later General) Jules von Verdy du Vernois was calling for the free conduct of wargames, without rules or calculations.[41] His concepts were quickly embraced, and his Frei Kriegsspiel became the standard for all subsequent games. Many of our most basic assumptions on wargames stem from his work.

Von Verdy's concepts also increased the utility of the wargame for use at levels higher than the tactical level for which it was originally designed. Though strategic wargames had been conducted as early as 1848 (when Chief of the German General Staff von Moltke conducted a game representing a war between Prussia and Austria) the freer forms of gaming were particularly suitable for simulating major operations and campaigns.[42] Thus, by the turn of the century German officers were playing 'Regimental War Games', 'Great War Games' (division level), and 'Strategic War Games' (army level). By World War I, operational war games played critical roles in education, planning, and analysis within the German Army.[43]

The Successes of German Operational Wargames

The use of operational level wargames reached its zenith during the interwar period between WWI and WWII. Not only were the games used as a replacement for large unit maneuvers, but they were also used to support the more general theoretical education of the officer corps. For

this, the wargame proved invaluable.[44]

It is interesting that much of this theoretical education took place in the unit, and not just in the schoolhouse. Theory, it was felt, needed to be studied not only in the abstract, but also as interpreted by commanders. Wargames offered a way of demonstrating a commander's understanding of theory without 'getting into the weeds' of a more traditional staff exercise.[45]

From an educational perspective, these operational level wargames were successful for a number of reasons. Most importantly, they were conducted on a regular and frequent basis. During the winter months, this meant games were played at least every other week.[46] In addition, the games were often played only by a 'specially selected and critical circle' of officers', often gathered only in a very small group setting.[47]

The Germans also used the wargame to reinforce other types of learning. As part of the curriculum at the German War College, for instance, officers used wargames to study historical campaigns. This provided the opportunity to explore the theoretical dimensions of warfare in an interactive manner, and in a way that helped portray a situation from the perspective of the commander who conducted the operations.[48]

Another strength of the German wargames was that they could be used for both educational and analytical purposes. Thus, the same game that was used to wargame the West Wall defensive system (1933), a new operations manual

(1936), and an invasion of Czeckoslovakia (1938), was used for educational wargaming. Theory, then, could be related to operations in a simple, straightforward manner.

The use of wargames for educational purposes was continued well into WWII. Wargames were found especially useful for major headquarters staffs prior to deployment, who used the games as an orientation on operations.[49]

Naturally, though, the emphasis was on the planning of upcoming operations and campaigns. Indeed, the wargame was used extensively in some of the most important operations of the war. For example, wargames were used to help plan the invasion of Poland in 1939, the invasion of France in 1940, and the invasion of Russia in 1941. The thoroughness of those plans was, in part, testament to the success of the wargame as an educational tool.

The wargaming of Plan Gelb, the invasion of France, serves as an excellent case study of how this tool was used. Actually, two wargames were conducted, each of which lasted several days. One game was a 'war game proper' supervised by the Assistant Chief of Staff I, General von Stuelpnagel. The other was a 'map exercise' conducted by the Chief of Operations Branch.[50] Although von Stuelpnagel's wargame was based on operational plans, the purpose of the exercise was not simply to carry out the plans in a wargame, but rather to provide a forum for the discussion of controversial problems. To this end, the group involved in the wargame remained very small and select. The map exercise, on the other hand, was designed

to provide an in-depth review of the feasibility of the plan itself. This exercise involved numerous staffs and was characterized by detailed analysis.[81]

Another reflection on the quality of German wargames of this era is that no major operational failures have been attributed to faulty game design or use. This has not been the case, however, with the games played by other armies.

The Failings of Others

All of the world powers had come to believe in the value of wargames after watching Prussia humble her opponents in 1866 and 1870-71.[82] From then until WW II the wargames of Britian, France, Russia, and Japan were essentially verbatim translations of Prussian works. While the Germans were largely successful in the use of the wargame, these other nations were not.

According to Paul Bracken, who has conducted a detailed study of the era's wargames, a great many of these failures were the result of unintended consequences. Verbatim translations aside, something in the defense establishment of each of these nations allowed wargames to yield false conclusions. Mr. Bracken viewed this something in terms of unintended diversion, suppression, and learning.

Unintended diversion results when attention is drawn away from a base problem and towards a more symptomatic one. The French suffered much from diversion, particularly evident in their belief in the invulnerability of the Maginot Line. French gaming became obsessed with detailed

calculations of ranges, concrete thicknesses, and dead fire zones, to the exclusion of other, more important, matters.[83]

Unintended suppression is the attempt to deny both unpleasant memories and future possibilities. The Russians were guilty of this in the wargames conducted in the years prior to the German invasion of 1941. These games were designed and conducted solely to confirm Stalin's deluded appreciation of the situation.[84] All other realities were denied and excluded from consideration in the games. For the Russians, then, suppression was by omission.

Suppression can take place through acts of commission also, wherein the game is adapted to produce desired results. The Japanese wargaming of the Battle of Midway best illustrates this type of suppression. It was during this game that the director adjusted the rules to allow a favorable outcome for the Japanese force.[85]

Unintended learning occurs when players take away from games concepts and principles not considered part of the game objectives. Though this can be of value, it can also become very disruptive, as was the case with the British modeling of air operations. Here, numbers produced by a model gave rise to a theory of war, which in turn, give credence to the numbers.[86]

The lesson to be learned is that the simple mechanics of wargaming are much easier to master than the understanding of how to use the games in the larger context of education. Without this understanding, even the best of

intentions can produce less than desirable results.

The American Experience

Very little is known about early wargaming experiences in the U.S. Army, although it appears as though various types of War Chess games were played well before the Civil War. The first really important work, however, appeared in 1879, when Major W.R. Livermore published American Kriegsspiel. Developed mainly from works of the Prussian von Tschischwitz, this game closely resembled German 'rigid' war games of the day.[87] Livermore's American Kriegsspiel included three games: a tactical game, a grand tactical game, and a strategic game. Each was governed by extensive rules. Though the rules were cumbersome, Livermore felt such detail was necessary. Unlike the Germans, he said, Americans lacked the experience needed in freer forms of wargames.

About the same time, Lieutenant C.A.L. Trotten developed Strategos, which he claimed was developed without reference to the German wargames.[88] His views on rules were exactly opposite those of Livermore. Indeed, Trotten felt that extensive rules were useful only to the professional European armies, and that the citizen soldiers of the American Army needed more simplicity. Thus, he developed Strategos as a set, with a basic and an advanced version of the game. His hope was that players would be able to progress from the elementary to the complex, 'being seduced to ever higher forms of gaming.'[89]

The free method of evaluation was introduced into American wargames in 1897, with Captain Eben Swift's translation of von Verdy's A Simplified War Game. Captain Swift was a firm believer in German Kriegsspiel and became the leading proponent of wargaming at both the Command and General Staff College (CGSC) and the War College up through the early years of the twentieth century.

Operational level war games formed an important part of the curriculum of both institutions up to the outbreak of the Second World War. At CGSC, the operational level games were played mainly as a part of the second year course (during the years when the second year of instruction was offered). By most accounts, the wargames of the second year course were a big success, for at least three reasons. First, the 'applicatory' method of instruction was not competitive as it was in the first year course.[80] Second, the games were played in small groups, normally with fewer than eight officers per group. And third, the games were played often. For instance, in the second year course for the 1933-1934, 48 map problems and map maneuvers were conducted.[81]

At the War College, wargames were given the same amount of emphasis. The academic year 1910-1911, for instance, included 69 map problems and 25 map maneuvers. Wargames increasingly were used to develop an 'art of command' in the officers, as opposed to staff appreciations. Small group wargaming was introduced, and starting in 1925, gaming of historical campaigns was added to the course.[82]

The U.S. Army relied on operational wargaming during WWII much less than Germany, or even Russia or Japan. The only operation extensively wargamed was the Overlord operation, and for this operations research techniques were used more than was the traditional wargame.

The Lessons of History

It appears that the criteria suggested by theoretical analysis have been validated by the experiences of history. This is especially true of the 'golden era' of wargaming, during the times prior to WWII. Perhaps without recognizing it, both the German and American armies developed educationally sound wargaming practices which stressed frequent games played in small groups. The operational level wargames were not intended to drive staff planning exercises, but to provide experience in a dimension of war normally seen by the highest commanders.

History has also provided further definition to several of the criteria. For instance, the fact that the earliest of wargames were simple and enjoyable undoubtedly contributed greatly to their lasting appeal and educational effectiveness. Leveled play, first introduced by Totten, provided a mechanism by which players could be 'lured' from the simpler forms of gaming to the more complex.

The criterion of Flexibility has also been clarified. Not only were the German wargames of value at different levels of command and in different theaters of operations, but they were also useful in the field as well as in the

schoolhouse. In addition, the same games could be employed for operational analysis as well as for education. History has likewise given us a better idea of what the criterion of Efficiency is about. In particular, the running debate between the advocates of 'rigid' and 'free' wargaming makes clear the fact that efficiency is not the product of one, but the sum of both. Depending on the experience of players and umpires, rules must always be used to provide form to the substance of wargames.

A revised listing of the criteria is shown below.

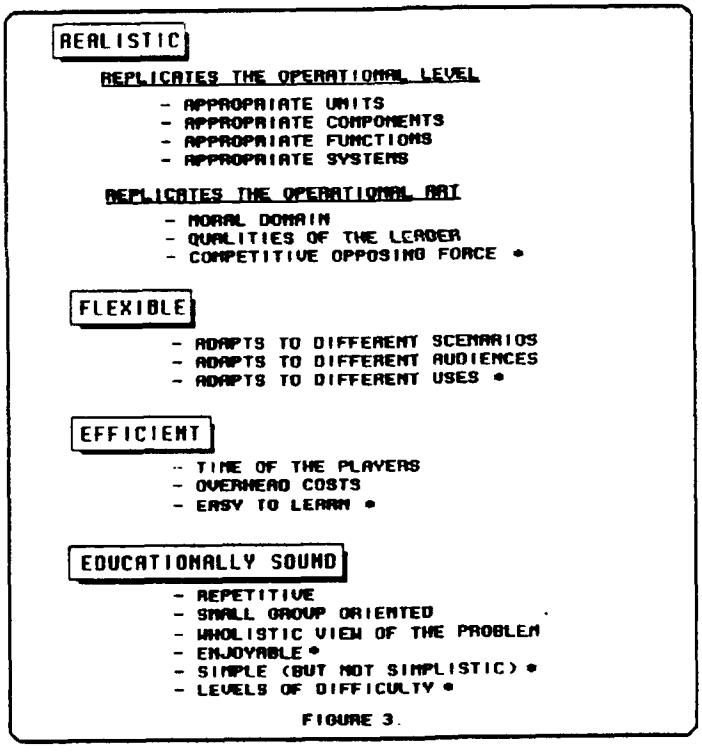


FIGURE 3.

IV. CONTEMPORARY ANALYSIS

Numerous changes have occurred since the WWII era. These changes in operational art, wargames, and education

must be accounted for, and applied to the development of our criteria.

The use of the term 'operational' as a distinct level of war or activity is fairly new to the U.S. Army. First introduced in the 1982 edition of FM 100-5, as 'the operational level of war,' the concept was transformed into the form of an activity as 'operational art' in the 1986 revision of the manual.Both of these manuals were a departure from what had been our doctrine since the end of WWII (but a return to pre war analysis of campaigning). In effect, we rediscovered classical theory. Much of this rediscovery was in terms of Clausewitzian theory, as opposed to Jominian theory. We began to realize that those who practice operational art must deal with the qualitative aspects of war as much as with the quantitative ones. The science of war, it was decided, was actually an art, and 'unknowns' of battle at least as important as the 'knowns'.

Wargames have also changed. Some of these changes have been a direct result of the emerging AirLand Battle doctrine as discussed above. Until the AirLand Battle doctrine was developed, there was no need for games to accommodate anything but the tactical or strategic perspective. Doctrine has also led wargame designers to focus on the qualities, as well as the quantities, of war.

Most of the changes in wargames, however, have come about as a result of the revolution in computer technology. Today, state of the art technology has the potential to solve a number of the problems which in the

past have somewhat limited the usefulness of operational level wargames. For the operational artist, technology now not only automates the calculus of the battlefield, but also creates the 'fog' through which the conflict must be viewed. Computer and communications networks help simulate the doctrinal linkages between tactics, operational art, and strategy by making possible a system of interconnected wargames. Technology can also increase the educational value of games by giving the players the ability to replay portions of the operation, and by doing 'what if' analysis.

The technological revolution has led to another important change in professional wargames. This is the separation of the computer model from the wargame. In the past, the two were implicitly combined, the model being the pieces and rules used to play the game. Today the wargame models are distinct from the game itself. Accordingly, different models can be used to drive a wargame exercise. Often, more than one is used.

Professional wargames, however, are no longer the only wargames being played. Indeed, another significant change in wargaming since WWII has been the growth of the commercially produced wargames.

The first modern commercial wargame was published in 1953. The game, called Tactics II, enjoyed moderate commercial success. The next two decades witnessed a tremendous expansion of the industry, and in the late 1970's the Army began contracting commercial wargame designers to produce tactical level training games.[23]

A suprising number of these commercial games have also been developed for the operational level of war. In fact, more than two hundred such games are currently available.[84] The first commercial game to incorporate air, land, and sea operations (needed for our more restrictive definition of operational war) was called Gulf Strike, which was designed by Mark Herman in 1983. Later, the design of this game was adapted for use by the Joint Chiefs of Staff and the National Defense University in strategic and opertional level wargaming.[85]

All things considered, the operational level of war has proved very amenable to the techniques of commercial wargames. With board games, for instance, the players are able to see the entire playing surface at once. This makes visual judgments of the overall situation possible, as does the physical handling of the unit markers.[86] Mr. Herman calls this the 'living map' effect. Commercial games have also helped define how rules can be used to provide 'synthetic experience' for people who otherwise would not possess the baseline knowledge needed to understand the operational requirements of the game. As such, 'natural' gaming systems have been devised to allow players to operate in as free a manner as possible.[87] Additionally, most operational level games feature scenarios and rules with varying degrees of difficulty.

Commercial wargames have also reintroduced us to the study of history through gaming. Most of the commercial games, in fact, are studies of historical campaigns. Once

popular in formal military courses, the wargaming of previous campaigns is now conducted also as a hobby. But it is a hobby enjoyed by many military leaders, who much like von Moltke (an avid wargame enthusiast), appreciate 'living' the lessons of the past.[69]

Much has changed in the field of education also. Relevant to our study has been the educators embrace of games and simulations as a viable means of building higher order cognitive skills. Games and simulations have spread to virtually every sector of education.[69]

As a consequence, much game research has been conducted independent of the military. This research has revealed two concepts which should be noted by the military. First, consider what educators say about the model. For them, it is in the direct manipulation of the model that learning takes place. Without such manipulation, cause-and-effect cannot be observed, and 'thinking frames' only incompletely defined.[70] For this to occur, the model must be <u>comprehensible</u> and <u>transparent</u> enough that the game itself does not become the learning event.[71] This is quite different from the trend in military wargaming, which increasingly hides the model from the wargame.

A second consideration is the work that has been done in relating game <u>structure</u> to cognitive development. See Appendix 2 for diagrams of the major types of structures. Games structured in a linear fashion, in which one can work completely through a problem step-by-step, have been found to be most suitable.[72]

All of these changes impact on the criteria being developed in this study, as shown in Figure 4. Shortly, we will use these criteria as a measure of current wargaming. First, however, we need to determine just what wargames are currently being used.

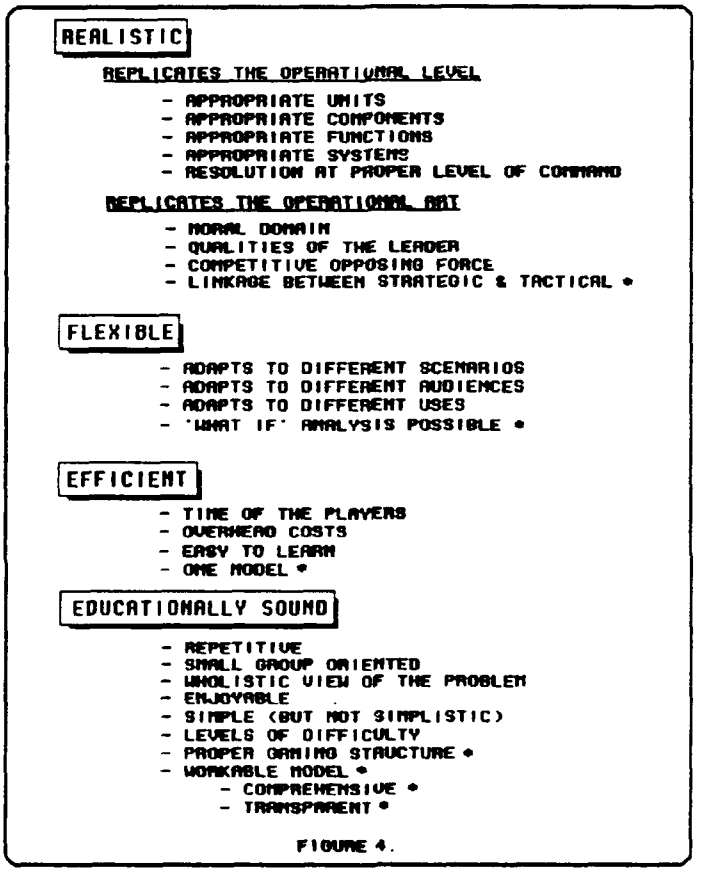


FIGURE 4.

The 'Universe' of Wargames

The Joint Chiefs of Staff currently list three hundred forty-seven manual and computer based models in the most recent publication of their Catalog of Wargaming and Military Simulation Models.[73] By definition, our concern is only with those games which can be used to educate officers in operational art. Given those filters, the total number of available wargames decreases considerably.

Of the three hundred forty-seven total games listed, only thirty-nine have been designed for use at the operational level of war. Furthermore, only thirteen of these thirty-nine are used for educational purposes. Finally, of these thirteen, only six allow joint and combined operations to be wargamed.[74] The universe of wargames suited for the education of operational artists, it seems, is smaller than one might think.

The six wargames which meet the definitional requirements of the study include the following: Ground Warfare Simulation (GRWSIM), Joint Armed Forces Staff College Wargaming System (JAWS), Joint Exercise Support System (JESS), Joint Theater Level Simulation (JTLS), Rand Strategy Assessment System (RSAS), and Theater and Corps Operations and Planning Simulation II (TACOPS II).

These are the models which can be used to drive operational level wargames. While the models form a core part of the game, they should not be confused with the game itself. Therefore, it is also useful to see which wargames are actually being played.

A summary of these games is presented in Figure 5, along with the location at which it is played, and the model used to drive the exercise. (Note that although the military school system forms the backbone of educational wargaming, a number of other courses or agencies do gaming for educational purposes.)

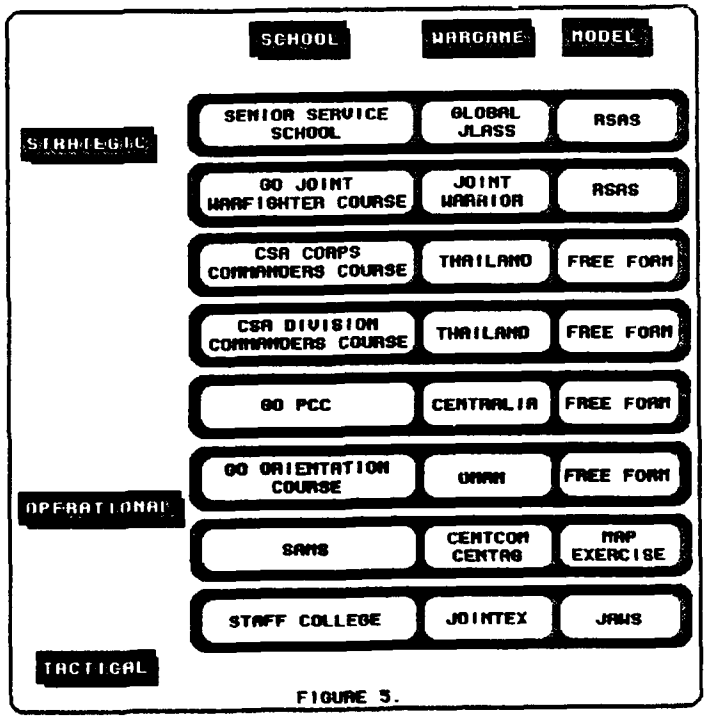


FIGURE 5.

When viewed from both perspectives, it becomes clear that the number of operational wargames is very small indeed. Of the six models previously mentioned, only two are extensively in use at the current time. These two models are JAWS and RSAS, and for our study will represent the state of the game in operational wargaming today. Both of these are briefly described below. Additional information on each can be found in Appendix 3.

The Joint Armed Forces Staff College Wargaming System (JAWS) is a computer assisted board game which has been used to support wargame exercises at the Armed Forces Staff College since 1982. JAWS was specifically designed to be able to test both deployment and operation plans of an operational level headquarters. It is two sided, and each

team (of about twenty officers) works from a hex-overlayed map, much like in a commercial wargame. All resolution of combat is done by the computer. The computer also provides logistic consumption, movement, and intelligence reports. Normally, about twelve days of battle are conducted in the twenty-eight hours alloted for the wargame.[78]

Unlike JAWS, which was designed as an exercise driver, the Rand Strategy Assessment System (RSAS) was designed to be used primarily as an analytical tool. It has, however, been used to support a number of educational wargames, as shown in Figure 5, and is currently available at all of the Senior Service Schools. RSAS is also different in that it views warfighting from a strategic-operational perspective, whereas JAWS has a tactical-operational perspective. Events can range from mobilization to conventional, tactical nuclear warfare, to a strategic nuclear exchange. RSAS can be used either interactively or in an automatic mode, wherein decision models execute war plans.[79]

Current Games and Lasting Criteria

The JAWS and RSAS models are not only 'state of the game,' but also represent the two approaches most often taken in our attempts to package operational level war into an operational level wargame. JAWS, as we have seen, approaches the operational game from a training perspective. It is designed to facilitate staff interactions and processes. The origins of this approach is in the tactical realm, where wargames of this type have

been relatively easy to develop. RSAS, on the other hand, approaches the operational wargame from an analytical perspective. It is designed not so much to train staffs as it is to provide probable results of conflict situations. The origins of this approach are in the strategic realm, where analytical games have flourished in the past.

There is nothing wrong with either of these approaches. But neither approach focuses on the particular gaming needs of the operational artist. Our criteria, then, should not only help us determine the adequacy of current operational level wargames, but also the adequacy of the approaches to operational wargaming itself.

JAWS does well in providing a realistic operational simulation. In general, the model provides an appropriate level of detail concerning the forces involved in a typical campaign. Because the model builds large-scale units by aggregating associated sub-units, players are able to manipulate organizations down to battalion, and even company, level. This visibility of smaller units is critical for logistics and special operations activities.

To a certain degree, the moral domain of operations is also accounted for in the wargame. Fog and friction, for instance, are introduced in the decision-making process of a commander and staff unfamiliar with one another. Uncertainty results from the fact that the threat is a real life opponent, often doing the unexpected and certainly trying to dominate the game as much as their opponents. Uncertainty is also a product of the model itself, in at

least two ways. First, the model supports a 'closed' wargame in which opposing sides only know as much about each other as their respective intelligence systems can provide them. Second, 'Monte Carlo' techniques are used, which builds chance into the very heart of the model.[77]

JAWS does well in terms of efficiency also. The computer performs all calculations, to include movement and combat resolution, as well as determining logistics requirements and constraints. As a result, players do not have to 'play in the weeds' in order to support realistic operations. In addition, the computer allows 'compressed' play, in which one hour of play can equal greater than four hours of simulation. Efficiency is also enhanced by the relative simplicity of the model and wargame. Only one model is used to drive the wargame, and the general rules for the game are less than fifty pages in length.[78]

Efficiency, however, comes at the expense of flexibility. Support structures needed are extensive, and are best realized in an institutonal environment. Programming support is required, and the preparation of data bases for new scenarios, for instance, can take several man-months to produce.[79]

The most significant shortcomings of the JAWS, however, are in relation to the last of our criteria, with JAWS' failure to support educationally sound processes. Like most wargames, JAWS was designed to support a relatively large exercise, most often one which is to be conducted once at the end of a course of instruction. In part, the

game becomes a 'role playing' exercise, in which seminar members learn the functions of the particular staff they are playing. Since the game was not designed to be played repetitively, each officer gets a very limited view of the operation. Thus, the structure of the game reinforces social interaction more than cognitive development.

RSAS, like JAWS, is a very realistic wargame. Unfortunately, RSAS was designed for strategic analysis, and the focus of realism is at that level. In effect, the operational level is the 'lower plank' of the wargame. Visibility for friendly units is down to the brigade level and to the division level for threat forces.[80] Geography, terrain, logistics, and combat adjudication are all highly aggregated, and support the global, rather than an operational, perspective. For all of these reasons, RSAS is the wrong tool for studying operational art.

Fog, friction, and uncertainty are introduced into the wargame in much the same way as they are in those games supported by the JAWS model. That is to say, staff interactions, live threat forces, and stochastic models all are used in an effort to portray the quality of the operational level of war.

Concerning efficiency, RSAS is in conflict. In terms of the time of the participant, RSAS can be very efficient. One entire day of war, for instance, can be run in about two minutes. The efficiency of the model is enhanced in another way, albeit indirectly. Because of the complexity of the model, current practice has the model isolated from

wargame participants. As a result, only a general understanding of the model is needed by the players. Little time is spent learning rules and procedures.

In terms of efficiency other than from the perspective of the players, however, RSAS does not fare as well. Efficiency for the players is the result of a great deal of technology. The technology itself is extensive. Probably even more so is the analyst and programming support. For instance, the 'war plans' needed to achieve the two minute gameday mentioned above often require one or two analysts several weeks, or even months, to develop.

Flexibility, in turn, is impaired by this dependence on the trappings of technology. In effect, the issue becomes not what the model itself can do, but what the organization can afford to sponsor. The costs associated with the model are considerable, and realistically limit the wargame to those organizations which can fund the long term support requirements. Flexibility is also degraded by the fact that the model is available only in a classified form.

The biggest weakness of RSAS, however, is that it does not fully support the educational process. As with JAWS, most of the exercises supported by RSAS are quite large, involving numerous staffs (or seminars). The exercises tend not to be oriented to true small group learning, nor is the game used in an iterative fashion.

Even more damaging, though, is the fact that the RSAS model has become isolated from both the players and the wargame. As such, it is no longer a question of the model

being comprehensible, or even transparent Rather, the model is nonexistent, at least from the player's perspective. Because of this, the wargame itself has little role in the development of expertise in the operational artist.

V. CONCLUSIONS

The purpose of this study has been twofold: First, to determine the criteria of wargames used to educate operational artists, and second, to determine the state of this type of wargaming as it exists in the U.S. Army. We began by looking at the theory of operational art, wargames, and education. Four criteria were identified, our analysis revealing that the games must be realistic, efficient, flexible, and educationally sound. We then saw how the experiences of history have validated, and even expanded, these essential criteria.

Current operational wargaming, though, does not appear to be in consonance with our criteria. In the first place, we found the 'universe' of operational level wargames to be quite small. Of these, only two models were considered to fit within the definitional boundaries of this study. But both of these, JAWS and RSAS, also were seen to have a number of weaknesses as presently used. Of the most concern for us is the lack of consideration for the educational value of the wargames. RSAS is an excellent analytic tool, but is less suitable in an educational

environment. JAWS, while an excellent trainer, lacks some of the design features required of an educational wargame.

Thus, a tension exists among the criteria. Any change in one criterion impacts on all the rest. In effect, if paramount importance is placed on realism, then the importance of realism is going to be paramount in the design of the wargame. This is what has happened with both JAWS and RSAS, and many other games of the same approach.

Accordingly, our concerns for training and analytic realism has dulled our appreciation for the educational merits of wargaming. Definitions of flexibility and efficiency, too, have been made relative to the needs of realism.

In the final analysis, the criteria of operational level wargames have been consistent throughout history, and are important even today. Though the criteria remain the same, changes in the theory of operational art and the technology of wargames have resulted in a skewing of the relative importance we place on each of the criteria.

Concerns for realism are unquestionably important. But they should not overshadow all other considerations. Our challenge, then, is to refocus our efforts. The boundaries of wargaming must not be defined exclusively by the technologies, theories, or doctrines of the time, but also by the criteria outlined in this paper. The implications are many, as our final discussion will reveal.

VI. IMPLICATIONS

The first, and most obvious, implication is that the criteria of operational wargames (Figure 5) should be understood and applied to our gaming efforts in the future. The criteria are not something new. They were not discovered in my efforts at research. Rather, they have been important throughout history. Although often applied without conscious effort, successful wargames have been designed in light of each of the criteria.

A second implication follows from this, and reveals a rather interesting paradox. In order to educate the operational artist, wargames must initially suspend part of what is considered to be an essential element of operational art itself. More specifically, the need to simulate the quality (as well as the quantity) of operational art must be balanced against the needs of the educational processes. Only then can the educational process -- designed to build intuition and judgement -- influence the operational artist such that he or she will have an appreciation of how to work through those difficulties later on.

Critical to the development of these skills is the synthetic experience which will allow officers to see the physics of the battlefield, to see them time and time again, and to see the processes of their planning in action. Wargames must be played multiple times and must be played in small groups so that the learning of the theory and art is not impaired by role playing or 'staff'

interaction requirements. Each officer must be involved with the overall concept of the operations, and must use the wargame model directly. Indeed, it is the experience of interacting with the model which will provide the basis for an eventual understanding of the art.

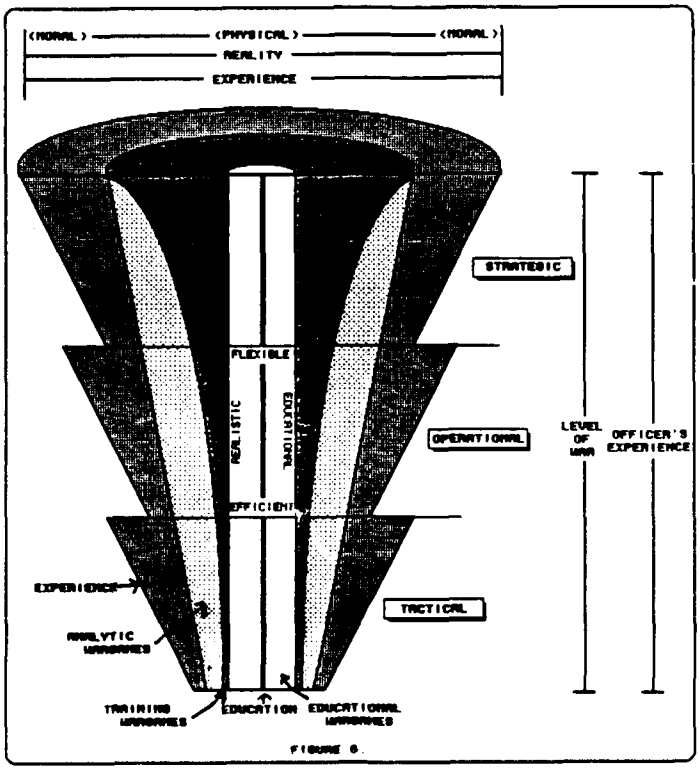
This leads to a third implication; that educational wargaming at the operational level may be better served by simpler wargame structures. Commercial wargames should not be rejected out of hand. Indeed, many of them incorporate educationally valuable features which surpass those of the most sophisticated (and expensive) professional games. Especially valuable is the 'living map' concept of these board games.

These implications, of course, are specific to the design of the wargame itself. As history has shown us, however, even the most well-designed wargames can produce the worst of results when the games are misapplied or misunderstood. A fourth implication, then, is that a system of wargames should be designed from an educational, as well as doctrinal, perspective.

Figure 6, on the next page, is offered to promote our understandings of such a system of wargames, and how educational wargames at the operational level should fit into the 'big picture'.

When viewed horizontally, the figure illustrates the wargame's close relation to the general education of the operational artist. It also suggests that other, more realistic training and analytic wargames should be built

upon the basis provided by educational wargaming. Each type of game should be utilized for what it is most suited for. Thus, the criteria for educational games should not



necessarily be extended to the other forms of gaming. By the same token, the criteria of the other games should not be used to judge the value of educational games.

When viewed vertically, the figure illustrates the idea that educational games are part of the 'core' of military competency. Both from the perspective of an individual's career and from that of the levels of war, wargames should be used to establish baseline understandings of theory and doctrine. As a corollary to this, it should not be assumed that a wide range of experience in a lower level of war equate to an understanding of the basic mechanics of the

next level. Experience, as we have seen, is relative to the situations from which it originates. The 'synthetic experience' of the educational wargame can be used to fill this knowledge gap.

If wargames are to be the core of our educational system, however, there must be a consistency in how they are designed and used. In previous times, as we have seen, wargames became very much a part of the culture of the officer corps. In fact, it was in such environments that the wargame was developed and flourished. We must define such a culture.

This also suggests that consistency goes beyond technological fixes. Currently, we look to technology, in the form of distributed wargaming and intricate computer models, to ensure linkage between the tactical, operational, and strategic levels of war. A more productive approach, I think, would be to link the criteria established in this paper to those of the strategic and tactical levels. Based on the common ground among them, a strategy for the development of true educational wargames could then be devised.

Wargames are as old as war itself. Like war, they have changed with the currents of time. Change currently offers great potential for the wargame. But change should not blind us to the lessons of the past. For educational wargames, much is to be gained by returning to some time honored basics.

APPENDIX 1

The current JCS Pub 1 definition of wargame is not the first to be viewed as somewhat vague. Rather, the term has meant various things to various people at various times. As a result, it has always been important to explicitly categorize one's definition of the term. Several taxonomies have been developed to help in such efforts, the leading examples of which are presented in this appendix.

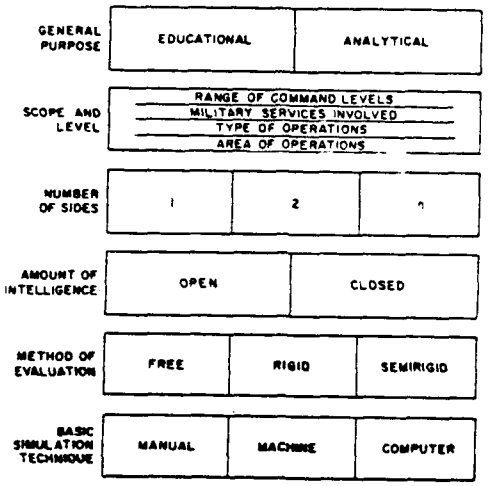
One of the classical taxonomies was provided by General Rudolf Hofmann in his 'War Game' report of 1951. This report summarized the German Army's use of wargames up to and including WWII. According to him, Kriegsspiele, as developed by the Germans, actually included a collection of different types of exercises. Specifically, the term wargame was taken to include war games proper, map exercises, staff exercises, training trips, tactical walks, command-post, and sand-table exercises. The meaning of the training trips, training walks, command-post, and sand-table exercises is self evident. The difference between the wargame proper, map exercises, and staff exercises is important, and merits further explanation. Each of these is briefly described below:

The War Game Proper. The purpose of a war game is to train officers in estimating any given situation -- the main emphasis being placed on a concise and logical presentation of ideas -- in making the resulting decision as to how the combat objective is to be attained, and in issuing orders designed to achieve this objective. As for combat adjudication, rigid wargames stress rules and procedures, whereas free wargames stress the experience of the players and umpires.

Map Exercise. The purpose of a map exercise it to train the participants in certain concepts and principles. The map exercise is conducted by only one side, and the main emphasis is placed on making a decision as to how the various weapons are to be employed and coordinated in carrying out the operational idea.

Staff Exercise. The purpose of a staff exercise is to train the participants in the functions of a staff during combat, thereby accustoming the personnel of the staff to team work. (Hofmann, pp. 1-36)

In 1966 another taxonomy was popularized in Francis J. McHugh's widely read Fundamentals of War Gaming. According to him, wargames can be classified into six categories, some of which have a number of subdivisions. The six categories are illustrated on the next page.



General Purposes. When the primary purpose of the game is to provide the players with decision-making experience, it is known as an educational game. When it is conducted in an attempt to obtain information and data that will help the commander to make decisions, the game is referred to as an analytical game.

Scope and Level. Games may be tactical, strategic, or a mixture of both (this taxonomy, of course, was formulated well before the operational level of war was recognized in the U.S. military). Some emphasize air operations, while others emphasize those on the land or sea. Some contain elements of all three. Geographically, games may embrace a limited area, a single area of operations (theater of operations), or several areas of operations (theater of war).

Number of Sides. Only the two sided wargames are considered 'true' wargames. One sided games are either considered analytical simulations or exercises in which the players compete only against a control group or the umpire. Multi-sided games most often are political-military games, which are normally associated with strategic gaming.

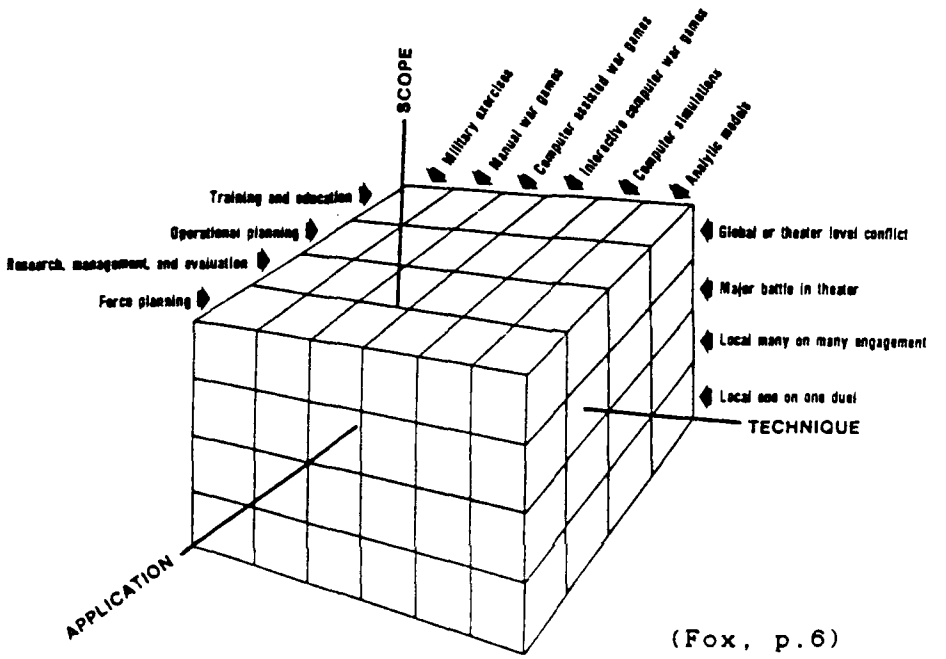
Amount of Information. When a game is conducted in such a manner that all players have access to complete information on each other's plans and forces, the game is known as an open game. If the players receive the amount and kind of intelligence that they would receive under real world conditions, the game is called a closed game.

Methods of Evaluation. Free umpiring is dependent upon the experience, judgement, and objectivity of the control group. Rigid umpiring is based on the models and data that reflect real-world interactions. Semi-rigid umpiring combines elements of both types.

Basic Simulation Techniques. This category is self explanatory, except for the fact that machine games would

now be considered computer assisted games. (McHugh, pp. 1-13 - 1-24)

In the late 1970's and the 1980's a taxonomy very similar to McHugh's was very popular. It, too, was graphically portrayed, as shown below:

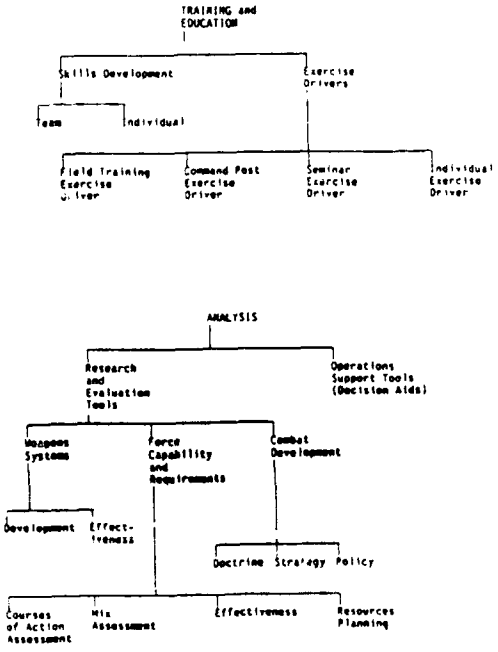


(Fox, p.6)

Most recently, in October 1989, the Military Operations Research Society (MORS) published the most comprehensive taxonomy to date in the report 'SIMTAX: A Taxonomy for Wargare Simulation'. This classification is now used in the JCS's 'Catalog of Wargaming and Military Simulation Models'.

The most basic categories of this taxonomy are the dimensions of purpose, qualities, and construction. These are considered relational to one another, and not hierarchical. Within each major category, however, there are a number of subcategories which are organized in a hierarchical manner. The following diagrams summarize the major categories of the taxonomy. Further information on these categories can be found in either of the two references cited above.

Purpose

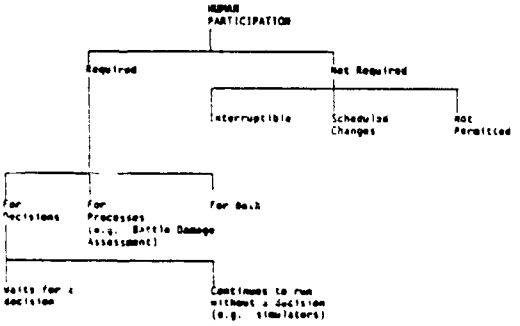


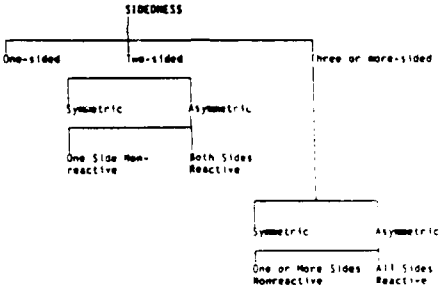
Qualities

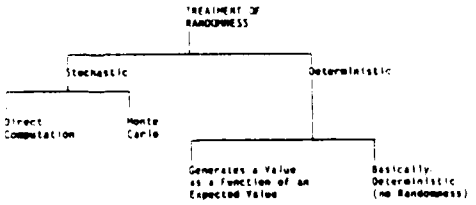
- Domain. The physical or abstract space in which the entities and processes operate. The domain can be land, sea, air, space, undersea, or any combination of the above.
- Span. The scale of the domain. The span can be global, theater, regional, local, or indiviual.
- Environment. The texture or detail of the domain. The environment includes terrain relief, weather, day, night, terrain cultural features, sea states, etc.
- Force Composition. The mix of forces that can be portrayed by the model. Force composition includes combined forces, joint forces, component, element, etc. Processes such as logistics, communications, and intelligence are included also.
- Scope of Conflict. The category of weapons. This includes unconventional, conventional, chemical, biological, and nuclear conflict, or combinations thereof.
- Mission Area. Recognized combinations of weapons and procedures used to accomplish a specific objective. Mission areas are sea control, close air support, indirect artillery fire, etc.

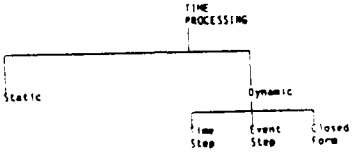
- Level of Detail of Processes and Entities. This has two dimensions. Entity level of detail has to do with what is the lowest, discrete entity modeled (such as army group, corps, air wing, naval task force, etc.). Process level of detail has to do with how process (such as attrition, logistics, communications, and movement) are described. Either they are aggregated from lower level processes or generalized from higher level ones.

Construction





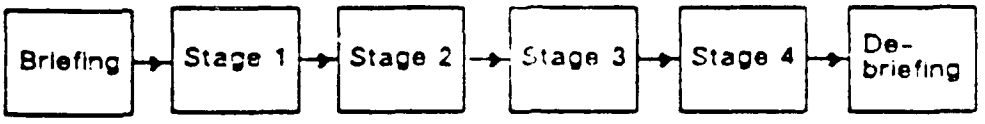




APPENDIX 2

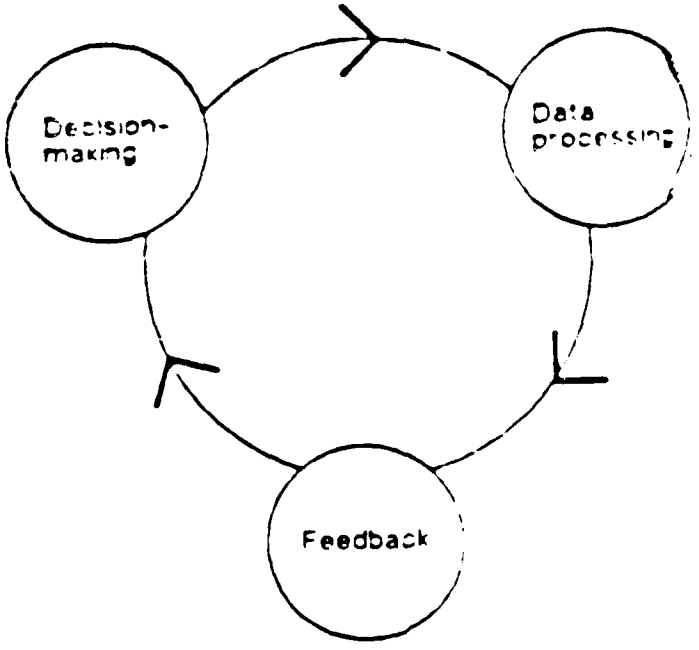
Henry Ellington, in How to Design Educational Games and Simulations, describes the five basic classes of exercises. Each of these is briefly described below.

Linear Structures.



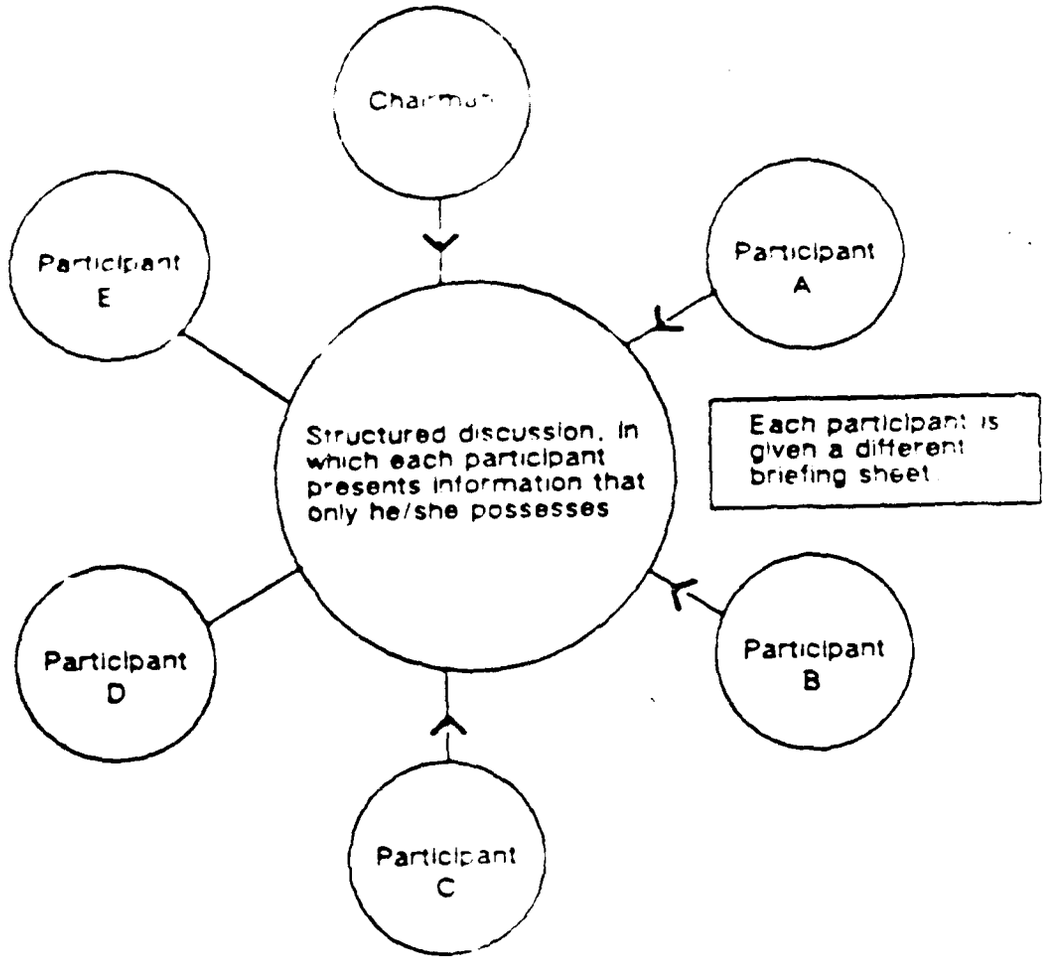
These structures are extremely useful with complicated cases. They are particularly suitable for developing high-level cognitive skills.

Cyclic Structures.



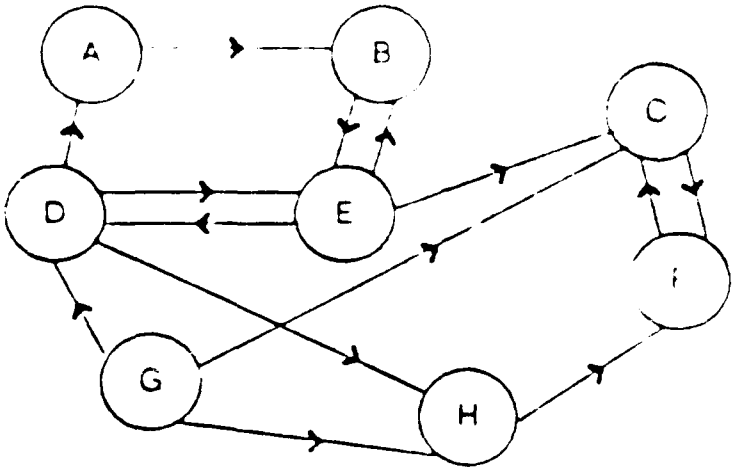
These structures are useful when activities take place in a repetitive series of cycles.

Radial Structures.



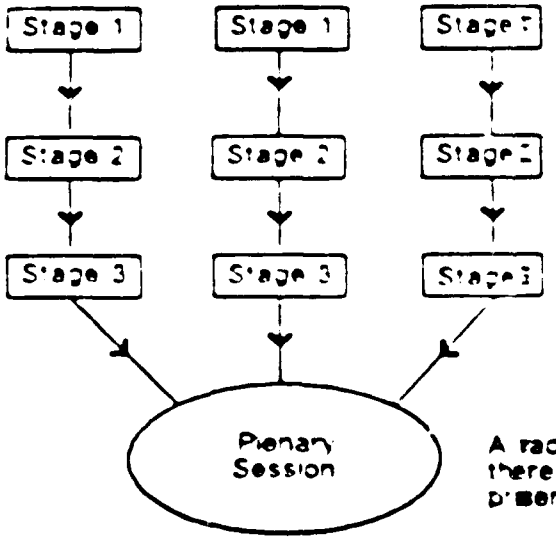
Radial structures are particularly wll suited for use in complex role-playing situations. They are ideal for developing communication and interpersonal skills, and for achieving affective objectives.

Interactive Structures.



These structures are ideal for simulating complex social, organizational, political, and international situations, and for the investigation of group dynamics. As with the radial structures, these are also useful for developing communication and interpersonal skills.

Composite Structures.



Parallel linear case studies carried out by different individuals or groups

A radial plenary session in which theresults of the case studies are presented and discussed.

By combining several of the different 'simle' structural elements, highly complex exercises can be produced.

APPENDIX 3

TITLE: JAWS - Joint AFSC Wargaming System

MODEL TYPE: Training and education.

PROPONENT: National Defense University, Armed Forces Staff College, 7800 Hampton Boulevard, Norfolk, VA 23511-6097.

POINT OF CONTACT: CDR H. L. Shotwell, (804) 444-5100, AV 564-5100.

PURPOSE: JAWS is used primarily to test the student's TPTRL and operation plans. It serves as both an operations support and a force capability assessment tool for mixes of forces or resources.

DESCRIPTION:

Domain: Land, sea, and air at about equal resolution.

Span: Depends on data base.

Environment: Hex-based. Discrete terrain and transportation factors must be chosen for each hex. Models day and night operations and different degrees of weather constant throughout the theater. Models roads, rivers, and transportation barriers.

Force Composition: Joint and combined forces, BLUE and RED.

Scope of Conflict: Conventional weapons.

Mission Area: Conventional; AFSC scenarios emphasize amphibious joint missions.

Level of Detail of Processes and Entities: The players give orders to units to initiate activities. Certain processes, such as air defense or withdrawal, are activated automatically. Ground attrition results are based on Lanchester coefficients. Air and naval engagements are based on probability of kill and Monte Carlo techniques. Pending event lists are maintained to control discrete events and processes.

CONSTRUCTION:

Human Participation: Required for decisions and processes.

Time Processing: Processes and pending events occur at a controller-specified ratio of exercise time to real time.

Treatment of Randomness: Land attrition deterministically based on Lanchester coefficients. Air, naval, and convoy attrition assessed through Monte Carlo techniques. Pending event lists are maintained to control discrete events and processes.

Sidedness: Two-sided, asymmetric, reactive. RED can be fully or partly automatic. Control can override any event or process.

LIMITATIONS: Aggregated level of detail for land, sea, and air operations.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Z-248 or IBM PC workstations are being implemented for ground operations, naval, logistics, and intelligence. The workstations can be used with either the micro or the mainframe version of JAWS.

INPUT: Scenario data base. Orders from gamers and control.

OUTPUT: Printouts of movement, attrition, intelligence, and logistic data as well as postprocessor statistics.

HARDWARE AND SOFTWARE:

Computer:	IBM, VAX, or CDC mainframe. Z-248 or IBM-pc microcomputers with 640 Kbyte memory.
Storage:	At least 10 MB hard disk drive.
Peripherals:	Two printers and two terminals or PCs for order input.
Language:	FORTRAN and "C."
Documentation:	Four programmer manuals and three gamer manuals.

SECURITY CLASSIFICATION: Unclassified.

GENERAL DATA:

Date Implemented: 1982.

Data Base: New scenario can take several man-months. Automatic programs are available to convert Joint Theater Level Simulation terrain to JAWS terrain.

CPU time per Cycle: Runs at ratio of simulated time to real time.

Data Output Analysis: End-of-game statistics. Games can be rerun from archived, time-tagged order input files.

Frequency of Use: 16 games per year.

Users: AFSC and NDU-INS-WGSC.

Comments: Source code maintained at NDU-INS-WGSC and AFSC.

TITLE: RSAS - Rand Strategy Assessment Syster

MODEL TYPE: Analysis (but has been used as a training model/exercise driver).

PROPONENT: Director, OSD/NA, The Pentagon, Room 3A930, Washington, DC 20301.

POINT OF CONTACT: Colonel Robert Gaskin, (202) 697-1312, AV 227-1312.

PURPOSE: RSAS provides a laboratory for the analysis of military strategy and operations in which alternative strategies and operations are evaluated in terms of the robustness of outcomes across the inherent range of uncertainty in scenarios, performance factors, and rules of war. RSAS can also be used for training and other requirements.

DESCRIPTION:

Domain: Land, air, sea, and limited space.

Span: Conventional and nuclear combat in data bases representing Northern, Central, and Southern Europe; Korea; and Southwest Asia theaters; naval combat in all oceans and major seas.

Environment: Four environments: main theater model (CAMPAIGN), alternate theater model (CAMPAIGN-ALT), naval model, and nuclear models. CAMPAIGN's geographic resolution is moderate and grid-based. Terrain is considered in an aggregate fashion as a function of the effect of terrain on maintaining or executing an offense or supporting a stalemate. CAMPAIGN-ALT encompasses a network of points and LOCs that explicitly account for terrain factors and geographic constraints in force movements and combat adjudication. The naval model allows aggregate differences in ASW, AAW, and ASUW in ocean regions based on variations in acoustic and environmental conditions. Nuclear models consider only environmental factors implicitly included in damage assessment criteria.

Force Composition: Nuclear forces played at individual weapon and weapon platform level. BLUE, RED, and GREEN joint and combined forces portrayed worldwide via a data base resident in the model.

Scope of Conflict: Theater and global conventional, theater nuclear, or strategic nuclear.

Mission Area: All conventional, theater, nuclear, and strategic nuclear areas.

Level of Detail of Processes and Entities: Individual weapons and weapon platforms modeled in the nuclear models. In the CAMPAIGN model, ground forces are modeled at the level of RED divisions and BLUE brigades (including most allied forces), air forces at the level of RED air regiments and BLUE air squadrons, and naval forces at the level of individual ships. Combat adjudication highly aggregated, but includes many parameters affecting theater-level combat that are only implicitly controlled by more fine-grain models. Combat adjudication output includes force attrition, FLOT location, force ratios, and aggregate damage levels.

CONSTRUCTION:

Human Participation: Permitted for all decisions, but the system can be run in an automatic mode relying on scripted decision log that makes all national-level, strategic, and theater-level decisions.

Time Processing: Dynamic, time- and event-step. Events at 12-hour, 4-hour, or 6-minute intervals depending on combat type.

Treatment of Randomness: Deterministic.

Sidedness: Two-sided, asymmetric, and reactive. Single operator can test and operate model.

LIMITATIONS: Continuous development intended to identify and improve areas of limitation.

PLANNED IMPROVEMENTS AND MODIFICATIONS: Areas of limitation are being improved as recommended by DoD Steering and Working groups, with the authorization of OSD/NA. Additional land theaters are under development.

INPUT: Model comes delivered and ready to run.

OUTPUT: Graphic and tabular output of the results of combat adjudication. Comparison of multi-scenario runs also possible.

HARDWARE AND SOFTWARE:

Computer:	Run on a SUN 3 family of systems under SUN OS 3.5.
Storage:	300 MB of disk space and 12 MB of memory recommended.
Peripherals:	Printer if desired.
Language:	"C" and RAND-ABEL (which compiles into "C").
Documentation:	Extensive descriptive documentation, but no true operating manual. Operating documentation being developed by a subcontractor.

SECURITY CLASSIFICATION: Secret.

GENERAL DATA:

Date Implemented: 1988 (development began in 1983.)

Data Base: A complete, easily modifiable data base accompanies the model.

CPU time per Cycle: N/A.

Data Output Analysis: N/A.

Frequency of Use: Varies by command, but is used at least several times per year with increasing frequency by those listed below.

Users: OSD, the Joint Staff, NDU, Naval Postgraduate School, Air College, CIA, DIA. Other users coming on line: PACOM, EUCOM, and other CINCs.

Comments: J-8 is currently evaluating model. RAND point of contact is Dr. Bruce Bennett, (202) 296-5000.

ENDNOTES

1. Rudolf Hofmann, "War Games," Historical Division of the United States Army Europe, 1952.

2. FM 100-5, Operations (Washington, DC: Department of the Army, 1986), p. 10.

3. John W. Masland and Laurence Radway, Soldiers and Scholars (Princeton, NJ: Princeton University Press, 1957), p. 50.

4. Three additional views on the difference between training and education are offered:

Robert Glaser has delineated two differences between education and training. First, training tends to be towards specific objects, while education tends to be toward broader objectives. Second, training seeks a certain uniformity, while education seeks to maximize individual differences by discovering and releasing individual potential. See Ernest R. Hilgard and Gordon H Bower, Theories of Learning (New York: Appleton Century Craft, 1966), P. 542.

A second view is offered by Elena M. De Costa:

> "People become educated, as against trained, insofar as they achieve a grasp of critical principles and an ability to chose, organize and shape their own ideas and living beliefs by means of them. Education is not a mere piling up of information. It is a process of autonomously deciding what is and what is not true and false...It is a process in which we learn to open our mind..."

See Elena M. De Costa, "Metacognition and Higher Order Thinking: An Interdisciplinarian Approach to Critical Thinking in the Humanities," in Thinking Across the Disciplines, the Proceedings of the Annual Conference of the International Society for Individualized Instruction, October, 1986, pp. 14-15.

And a third view. According to Masland and Radway, there is not actually a clear and defined distinction between training and education. Rather, they see the whole learning process as a spectrum, with "pure training" (such as a simple exercise in assemblying a rifle) at one end, and with "pure education" (involving the highest levels of abstraction) at the other. De Costa, p. 51.

5. JCS Pub 1, Dictionary of Military and Associated Terms (Washington, DC: The Government Printing Office, 1987), p. 393.

6. Here are some related definitions taken from JCS Pub 1 and 2:

Analytical models: Simulations to improve understanding or help with decisions such as force structure analysis.

Exercise: A simulated wartime operation involving planning and execution carried out for training and evaluation purposes.

Gaming: A technique in which the learner is presented situations involving choice and risk.

Model: A mathematical or logical representation of warfare; simulated representation of some entity.

Simulation: Carrying out the steps or computations of a model in order to determine what will happen in a given set of circumstances.

7. John Prados, Pentagon Games (New York: Harper and Row, 1987), p. 77.

8. A. S. Mobley, 'Unlocking the Potential of War Games: A Look Beyond the Black Box,' Thesis, Naval Postgraduate School, Monterey, CA, 1988, p. 5.

9. These, of course, are the driving forces behind the resurgence in interest in wargaming today. This is stated quite well in this not too recent quote:

> 'The raison d'etre of the game is easily apparent. Modern wars are short and infrequent, and when they occur there is no time to gain experience before the armed clash comes. As much of this experience as possible must be had beforehand in a way which is the best substitute for actualities. A great deal of this experience may be gained by maneuvers, but maneuvers are too expensive to be indulged in on a large scale very often...'
>
> - Scientific American, 5 Dec 1914.

10. Peter P. Perla and Raymond T. Barrett, 'Wargaming and Its Uses, Research Memorandum, Center for Naval Analysis, Alexandria, VA, 1984, pp. 3-4.

11. Booz-Allen and Hamilton, Inc., 'Strategic Analysis Simulation,' Product Pamphlet, Arlington, VA, 1987, p. 1.

12. Carl von Clausewitz, On War, Translated by Michael

Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1984), p. 128.

13. Ibid., pp. 178-179. He further defines the problem as being one based on 'intellectual complications' and on an 'extreme diversity of factors and relationships'.

14. LTC John E. Turlington has eloquently described this linkage as that which 'gives substance to strategy and meaning to the loss of life and material inevitable on the battlefield.' ((P34/52)

15. Clausewitz, pp. 100-103.

16. Ibid., p. 578.

17. Lauren B. Resnick states that higher-order thinking includes the following characteristics:

- is non-algorithmic
- is complex
- yields multiple solutions
- involves nuanced judgement and interpretion
- involves the application of multiple criteria
- involves uncertainty
- involves self-regulation
- involves imposing meaning and finding structure in apparent disorder
- is effortful

See Education and Learning to Think (Washington, DC: National Academy Press, 1987), p. 3.

18. Herbert A. Simon, 'Making Management Decisions: The Role of Intuition and Emotion,' Academy of Management Executives, February 1987, p. 59.

19. Ibid., p. 57. The term nonrational is used to mean decision making based on intuition and judgement. This should not be confused with irrational decision making, which is based solely on emotions. The term rational, or logical, is applied exclusively to decision making that is consciously analytic.

20. Metacognitive and self-monitoring skills include knowing what one knows and does not know, predicting the outcome of one's performance, planning ahead, efficiently apportioning time and cognitive resources, and monitoring one's efforts to solve a problem. Robert Glaser, 'Education and Thinking: The Role of Knowledge,' American Psychologist, February 1984, p. 102.

21. This school of thought thus emphasizes courses which teach thinking strategies. These problem-solving courses and programs vary in scope and style, ranging from individual courses or laboratory programs to multi-course

ones spread over several years. Some of the more well known approaches include Wales and Stager's 'Guided Design,' de Bono's 'CoRT Thinking Program,' and Covington's 'Productive Thinking Program.' Resnick, pp. 19-23.

22. Glaser, p. 100.

This perspective of the expert is based on research on the games of grand master chess players. This research showed that grand masters could only memorize the layout of chess pieces on a chess board when the pieces were arranged as they would be in the course of normal play. If a random layout was given them, they could recall the positions of the pieces only as well as a novice. These results indicate that the grand masters knew something very powerful, but only very specific to the game of chess. The strength of the grand master's intuition and judgement, then, was in his previous learning of patterns, and the significance of those patterns. Chase W.C. and H.A. Simon, 'Perceptions in Chess,' Cognitive Psychology, Vol. 4, pp. 55-81.

23. Simon, p. 63.

24. Resnick, p. 46.

25. D.N. Perkins and Gavriel Salomon, 'Are Cognitive Skills Context-Bound?' Educational Researcher, January-February 1989, p. 17.

26. Glaser, pp. 98-99, 102.

27. Jack Gordon and Ron Zemke, 'Making Them More Creative,' Training, May 1986, p. 42. Doug Stewart, 'Thinking Sideways,' New Age Journal, May 1986, p. 34.

28. Sarane S. Boocock and E.O. Schild, Simulation Games in Learning (Beverly Hills, CA: Sage Publications, Inc.), pp. 213-214.

29. Resnick, p. 41. Also, Robert D. Tennyson, 'Instructional Design for the Improvement of Learning and Cognition,' in the Proceedings of Selected Research Papers presented at the Annual Meeting of the Association for Educational Communications and Technology, New Orleans, LA, January 14-19, 1988, p. 10.

30. Francis J. McHugh, Fundamentals of Wargaming (Newport, RI: Naval War College, 1966), p. 2-1. Also, Daniel B. Fox, 'A Conceptual Design for a Model to Meet the War-Gaming Needs of the Major Commands of the United States Air Force,' Research Report, Air University Press, Maxwell Air Force Base, AL, 1986, p. 9.

31. Both the game of Go and Wei-Hai closely follow the

teachings of Sun Tzu, especially those dealing with the importance of maneuver and the "extraordinary force." Wei-Hai means "encirclement."

The game of Chaturanga was played on a playing board, and pieces representing foot soldiers, light cavalry, and elephants were moved about by four players. It is widely thought that the game was used as a humanitarian alternative to actual combat.

32. Actually, the Europeans got it by way of the Persians: Mohammedan conquerors carried chess from Persia, across Africa, and into Spain and Europe. The name of the game, chess, most certainly is a corruption of the Persian word shah, or king. The final move of checkmate, derives from the phrase shah mat, the king is dead. Kingsley S. Anderson, The Game of War (Burlington, MA: Technical Operations, Inc., 1960), p. 1-2.

The modern rules for chess were developed in the fifteenth century. Based on the state of the art in warfare at the time, the rationale for the various rules in the game are self evident. For instance, each player was given only one move per turn due to the difficulty in controlling armies on the actual field of battle. The board itself represented the flat, featureless terrain needed for an engagement to take place. The queen represented the single best body of troops, the opponent's center of gravity. The king, while important for the final outcome, was himself of little talent or usefulness. James F. Dunnigan, The Complete Wargames Handbook (New York: Morrow Press, 1980), pp. 141-142.

33. McHugh, p. 2-2.

34. In "King's Game" each player was given thirty pieces, which could be maneuvered on an enlarged board in fourteen different ways. The pieces included on king, one colonel, one marshal, one captain, two knights, two chancellors, two heralds, two chaplains, two couriers, two adjutants, three bodyguards, three halberdiers, and eight private soldiers.

35. Anderson, p. 4, and John P. Young, "A Brief History of War Gaming," Staff Memorandum, Combat Operations Research Group, Fort Monroe, VA, 1955, p. 5.

Helwig's game is often referred to as the origin of the modern commercial wargame. Francis B. Kapper, "Sun Tzu, The Spring Offensive and the Home Hobbyist," Defense, May 1981, p. 22.

36. McHugh, p. 2-5, and Young, pp. 5-6.

37. War chess was played on a modified chess board with 1,666 small squares. These squares were tinted to show differences in terrain, with red representing mountains; blue, water; light green, marshes; dark green, forests;

black and white, level ground; and half-red, buildings. McHugh, p. 2-3.

The pieces used were similar to traditional chess pieces. It is speculated that the term 'Queen of Battle' for Infantry may have originated from Helwigs game, as the piece representing the infantry could move much like a queen in traditional chess. James W. Cannon, 'Wargaming - A Sound Procedure for Testing Military Plans and Concepts,' Student Thesis, Army War College, Carlisle Barracks, PA, 1969, p. 7.

38. Vinturinus's 'New Kriegsspiele' was even more complex than was Helwig's 'War Chess'. Indeed, the book in which the game was described required over sixty pages to describe the complex rules governing movement and combat. The playing board contained 3,600 squares, and up to 1,800 brigade size units could be played by the two opponents. The board, unlike those of previous games, was designed after a real piece of terrain (between France and Belgium), although the attempt was primitive. Cannon, p. 8, and Anderson, p. 4.

This game was severely criticized, even in its day. Von der Goltz wrote:

> 'This war game is a bad product of the refined military education of the period, which has piled up so many difficulties that it is incapable of taking a step in advance...A science of war as conceived by Vinturinus does not exist.'

39. McHugh, pp. 2-6 - 2-7.

40. The principle improvement to the wargame made by Herr von Reisswitz (the Senior) was his use of a terrain model made of sand, and later plaster. The game was also simple, realistic, and attracted the attention of King Frederich Wilhelm III.

Von Reisswitz (the Junior) transferred his fathers' game to a map in 1824, and made a number of additional improvements. For the first time, all of the elements of a wargame were present, to include extensive use of the umpire and the writing of scenarios. The map itself was at a scale of 1:8,000 (which showed about four miles of ground) and was of an 'ideal' area. Games were played in real time and only limited intelligence was given each of the two opponents.

41. Anderson, p. 7.

42. McHugh, p. 2-9.

43. German success with wargames was mixed during WWI. A

great success was the wargames conducted prior to the 1981 offenses. The great failure was the wargaming conducted prior to the execution of the Schlieffen Plan. Andrew Wilson, The Bomb and the Computer: Wargaming from Ancient Chinese Mapboard to the Atomic Computer (New York: Delacourt Press, 1969), pp. 22-24.

44. Geunther Blumentritt, "Miscellaneous Military Problems," Historical Division, European Command, 1948, p. 22.

45. Hofmann, p. 187.

46. Ibid., p. 40.

47. Mobley, p. 37. See also the article "War Games" in the June 1961 edition of Military Review, p. 71.

48. Hofmann, p. 75. General Hofmann, however, also spoke of the dangers of historical wargames in his post WWII report War Games. According to him, it must be understood by all that only the original situation of the game will be accurate, and that everything from that point on will run differently from the historical accounts. (Page 11)

49. Ibid., p. 6.

50. Both games were conducted at the Army High Command, the headquarters being located at Zossen, Germany.

51. Hofmann, pp. 31-33.

52. Colonel Middleton of the British Army commented:

> "The game of war, like the breach loader, is by no means a new idea, and it doubtless owes its present form to the late wonderful successes of its inventor, the Prussians. Now, without going so far as some of its greatest admirers do, who attribute those successes principally to its use by the Prussians, I have no doubt that the lessons taught by tolerably frequent and careful playing of the so-called "War Game" must be of great value to the thinking soldier anxious to master his profession." Quoted in McHugh, p. 2-10.

53. Paul Bracken, "Unintended Consequences of Strategic Gaming," Simulation and Games, September 1977, pp. 287-293.

54. Ibid., pp. 294-299.

55. Ibid., pp. 293, 296-298.

56. Ibid., pp. 300-312.

57. Young, pp. 14-15.

58. Anderson, p. 8.

59. Totten wrote that this series of games was intended to:

> 'blend and fade one into another so gradually and so naturally that the student will be almost unwittingly entrapped into continually higher and higher forms of study until at length the mere tyro...will find himself actually venturing to command an army, and essay with growing confidence those deeper and more absorbing problems which alone test generalship and seal the fate of nations.'

60. The applicatory method was the school's hands-on approach to learning. A method of instruction developed in the German Army, map maneuvers (two-sided wargames), map Problems (one-sided wargames), and tactical rides were frequently conducted. All required the active participation of the students.

61. Command and General Staff School, 'Problems,' Second Year Course Curriculum, Fort Leavenworth, KS, 1934, pp.3-6.

62. Harry P. Ball, Of Responsible Command: A History of the U.S. Army War College (Carlisle Barracks, PA: The Alumni Association of the U.S. Army War College, 1989), pp. 106-110, 124, 171-172, 192. Wargames were conducted on the following campaigns: the Muese-Argonne Offensive, the German 1916 offensive in Rumania, and operations of the French and German Armies in 1914.

63. Peter P. Perla, The Art of Wargaming (Annapolis, MA: U.S. Naval Institute, 1990), pp. 114-117.

64. This figure is based on my review of the database of Tom Slizewski, who is working on a new book on commercial wargames. The database includes all games available as of 1982. Mr. Slizewski is the author of Wargames: Game Collectors's Guide Volume I, which was published in 1989. Obviously, the book is the more up-to-date source. Unfortunately, however, it does not indicate the level of war of the games. The two of these sources represent the most complete listing of commercial board games available today.

65. Perla, p. 145. The comment is also based on conversations with Mark Herman on 21 February 1990.

66. Perla, pp. 199-203.

Many authors also say that commercial games benefit from the fact that they must sell to be successful. This ensures that the game is enjoyable as well as educational. It is also claimed that commercial wargames are more 'honest' than some professional games because the data and models are more open to debate and review. Garry D. Brewer and Martin Shubik, The War Game: A Critique of Military Problem Solving (Cambridge, MA: Harvard University Press, 1979), p. 39.

67. Perla, pp. 314-316.

68. According to Thomas B. Allen, author of War Games, both General Kelly of the Marine Corps and General (Retired) Meyer of the US Army, are avid hobby gamers. (See p. 111)

Count von Moltke was an industrious player of wargames throughout his career, to include the times of his tenure as Chief of Staff of the Prussian Army. He founded the Magdeburg War Game Club in 1850. Young, p. 9.

An excellent review of historical wargames, their value to the study of history, and recommended steps in initiating a study program, is contained in Captain Eric M. Walter's article 'Studying Military History With Wargames,' in the December 1989 Marine Corps Gazette.

Apparently the Marine Corps is getting serious about the use of these wargames. In the same issue of the Gazette, Colonel Raymond A. Hord states that the Marine Corps Wargaming and Assessment Center is examining the idea of establishing a library of commercially produced wargames. (See p. 40)

69. Ellington, p. 5.

70. Perkins, p. 7.

71. Paul K. Davis, 'Game-Structured Analysis as a Framework for Defense Planning,' A RAND Note, The Rand Strategy Assessment Center, Santa Monica, CA, 1988, p. 24.

72. Ellington, p. 5.

73. Joint Chiefs of Staff, 'Catalog of Wargaming and Military Simulation Models,' Joint Analysis Directorate, Washington, DC, 1989, pp. Appd1-Appd9.

74. Ibid., pp. M-13 - M-16.

75. Armed Forces Staff College, 'Joint AFSC Wargamining

System, Volume I, Players Manual,' National Defense University, Norfolk, VA, 1989, p. 15.

76. Bruce W. Bennet, 'RSAS 4.0 Summary,' The RAND Corporation, Santa Monica, CA, August 1989, p. 29.

77. JCS, 'Catalog of Wargaming and Military Simulation Models,' pp. J9-J10.

78. Armed Forces Staff College, ' Joint AFSC Wargaming System,' .

79. Ibid., p. R18.

80. Bennet, pp. 80-81.

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